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ABSTRACT

One of a series of sixteen knowledge transformation papers, this paper examines the advantages and disadvantages of longitudinal studies as a method for evaluating vocational programs. First, longitudinal methods are defined for the differences between them and cross-sectional studies are established. The results of a literature search conducted on the ERIC database are provided, showing that eighteen studies relevant to vocational education used longitudinal methods. Then, the importance of longitudinal data is emphasized because of its role in studying the relationships between vocational program practices and student development. In the next section, ways to implement longitudinal studies are discussed. The data requirements are found to include input information on biography and enrollment; process data, such as student progress and program characteristics; and output information on termination, initial placement, and follow-up. The conclusion acknowledges the problems associated with such studies to be the complicated process of data collection, the length of time involved, and the lack of prototypes for vocational educators to follow. References are cited at the end. (ELG)

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LONGITUDINAL METHODS AS TOOLS FOR EVALUATING VOCATIONAL EDUCATION

written by

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FOREWORD

Now that educators have been asked to account for and justify vocational programs to federal, state, and local agencies, more sophisticated evaluation techniques have become necessary. As a result, vocational educators have expressed concern over identifying the most cost-effective procedure for evaluating vocational programs in specific situations. This paper provides information on the advantages and disadvantages of one technique for evaluating vocational programs--the longitudinal study. Some examples of the application of longitudinal methods to vocational education are also presented.

"Longitudinal Methods as Tools for Evaluating Vocational Education" is one of a series of 16 papers produced during the first year of the National Center's knowledge transformation program. The 16 papers are concentrated in the four theme areas emphasized under the National Center contract: special needs subpopulations, sex fairness, planning, and evaluation in vocational education. The review and synthesis of research in each topic area is intended to communicate knowledge and suggest applications. Papers should be of interest to all vocational educators, including administrators, researchers, federal agency personnel, and the National Center staff.

The profession is indebted to Dr. David J. Pucel for his scholarship in preparing this paper. Recognition is also due Dr. Jerome T. Kapes, Texas A & M University, Dr. Laurabeth Hicks, U. S. Office of Education, and Dr. Kay A. Adams, the National Center for Research in Vocational Education, for their critical review of the manuscript. Dr. Carol P. Kowle, research specialist, supervised the publication of the series. Ms. Jo-Ann Cherry coordinated editing and production.

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INTRODUCTION

Now that educators have been asked to account for and justify vocational programs to federal, state, and local agencies, the need for more sophisticated techniques for evaluating vocational education has increased. In the past, many vocational educators felt that formal education was an unnecessary burden in the operation of vocational education programs. If the success of a program could be determined informally, then more money resources would be available for operating programs. This situation is now changing. Most vocational personnel would agree that evaluation, which produces data which can be shared with decisions makers, is a necessary part of the present and future operation of a program.

The question no longer is, "Should one evaluate?" The question is, "What types of procedures will be cost-effective for evaluating vocational programs in specific situations?" This paper is written to provide information concerning the advantages and disadvantages of using longitudinal methods of evaluating vocational education. Some examples of the application of these methods to vocational education are also given.

LONGITUDINAL METHODS

In general, longitudinal methods refer to those used to gather information over a period of time. However, much more precise definitions are available. According to the Encyclopedia of Educational Evaluation, "In a longitudinal study, repeated measurements are taken of the same subjects, usually over a long period of time." (Anderson et al., 1975, p. 229). The assumption in a pure longitudinal evaluation is that each of the measures taken at different points in time will be comparable, which results in the term "repeated measurements." In fact, it has been suggested that, in order for a study to be a true longitudinal study, the same instrument must be used to gather the information each time information is gathered. As Anderson and associates (1975) state: "Some purists argue, however, that a true longitudinal study cannot tolerate changes in instrumentation across successive measures" (p. 231).

An example of a pure longitudinal study in vocational education would be to follow up the graduates of a vocational horticulture program one, three, and five years after they graduate from the program. The same follow-up instrument would be used so that the same data would be gathered each time. The basic purpose would be to see what changes occurred after one, three, and five years. In this study, the same information would be gathered from the same people each time with the same instrument. It would take a minimum of five years after the class graduated to gather all of the information necessary to determine what changes actually did occur one, three, and five years after graduation.

This type of study is contrasted with a cross-sectional study. A cross-sectional study gathers the same information from different groups of individuals who have been selected because they represent different stages of development. The data from these different groups are compared to determine what changes occur as people or programs progress through different stages of development. For example, rather than waiting five years to gather the information on the graduates of the horticulture program, a group of individuals that graduated one year ago would be identified, another group that graduated three years ago would be identified, and another group that graduated five years ago would be identified. These individuals would be administered the same follow-up instrument at the same time and the results would be compared to determine what changes were experienced by graduates one, three, and five years after graduation.

There are advantages and disadvantages to each of these types of procedures. The major advantage to the longitudinal study is that the same group is surveyed over different periods of time. The group is the same because the data are actually gathered from the same individuals each time. A major disadvantage is that a longitudinal study requires a long period of time before all of the information is gathered for analysis and decision making. Many times program operation decisions cannot wait that long. Another disadvantage, particularly if test data are being gathered, is that the same group of people see the same instrument over and over again and may get higher scores as time progresses because of familiarity with the instrument.

The advantage of a cross-sectional study is that it can be accomplished within a shorter period of time. All of the information can be gathered at the same point in time because it is gathered from different groups of individuals. The major disadvantage, however, is that one must assume that the data gathered at the same time from different groups of individuals who represent different stages of development are equivalent to data gathered from the same group of people at the same stages of development. Many times this assumption is difficult to make.

For example, is it reasonable to assume that decisions made from data gathered from a graduating class one, three, and five years later will be the same as decisions made if the same data are gathered from different groups of graduates one, three, and five years later? Differences between the one, three, and five year data in the first case can be attributed to changes that occurred over time. Differences between the one, three, and five year data in the second case may be attributed to differences in the groups of individuals from which the data were gathered (one, three, and five year graduates) and/or changes that may have occurred over time.

As can be seen from the examples above, both the longitudinal and cross-sectional evaluation designs take into account change over a period of time. They are viewed as development evaluation designs, because they examine the development of some situation over time. Both of these types of studies can be contrasted with "one-shot" evaluation. That type of study is the one most often used by

vocational educators in conducting follow-ups and other descriptive studies. The graduates of the horticulture program would be followed up one year after graduation and the results described without examining what happened to these individuals over different periods of time. Another example would be counting and reporting the number of people entering a program.

Both the longitudinal and cross-sectional designs have limited uses in evaluating vocational education when used in their pure forms. They are primarily designed to examine individuals, programs, or other phenomena to determine development or lack of development over time. Used in this way, their primary use would be to answer questions like the following:

1. What changes occur in the employment situations of graduates as they develop their careers?

2. What factors influence student choices as they mature?

3. How do the skill levels of students change with increased amounts of instruction?

These questions represent the many types of questions that need to be asked in order to evaluate and improve vocational programming.

Other primary concerns of vocational educators are to determine the relative efficiency or comparable performance of programs, or to identify factors leading to success of students. Therefore, this paper addresses longitudinal methods from a much broader perspective than that of a pure longitudinal evaluation.

Longitudinal methods are treated here as tools that would be useful in gathering information from the same individuals or programs over time without the restriction that the information must be gathered with the same instrument or be comparable information. Longitudinal methods in this paper are viewed as involving the development and analysis of a data base over time that pertains to a given individual, class, program, school, or other unit that one wishes to evaluate. The use of this definition allows for the examination of relationships between different types of information that can be gathered about a particular individual or program. For example, a decision maker might be interested in the relationship between the clerical aptitude of students entering a secretarial program prior to taking part in the vocational program and their employment supervisors' ratings of performance after they graduate from the program. In order to address this question, it would be necessary to gather the clerical aptitude information from individuals before they enter the program and to gather the supervisor evaluations after graduation. Although these two types of information are quite different, in order to study the relationship between them, it would be necessary to gather information from the same individual at varying points in time.

LITERATURE REVIEW

An ERIC search was conducted to identify studies which used longitudinal methods. The abstracts of many studies were reviewed. Only eighteen studies could be identified which apparently utilized longitudinal methods that would have relevance to evaluation problems faced by vocational educators. Of these, one study used the pure form of the longitudinal method described earlier, in only one section. This study undertook to follow-up the total ninth grade classes of three medium-sized Pennsylvania school districts for a period of ten years (Kapes et al., 1974). A wide variety of psychological tests, grades, and school success information were gathered on the same students repeatedly as they progressed through their high school programs. The data collected were then analyzed to determine changes in the students over periods of time and to see if the changes in the students were affected by the types of programs in which they enrolled and other variables. Data were also used to examine relationships between different types of data such as what factors might be related to dropping out of a program as contrasted with successful completion of a program.

Another study which collected truly longitudinal data for three consecutive years was Project LONGSTEP (The Longitudinal Study of Educational Practices) which attempted to evaluate different developmental projects aimed at increasing language and math skills. Coles and associates (1976) stated that "The general emphasis of Project LONGSTEP was on the identification of changes in student achievement that occurred as a result of intensive educational innovation" (p. vi). It was designed to relate four basic categories of data: home background, initial achievement status, educational treatment, and teacher characteristics, to posttest performance. Although the study gathered some of the data from the same individuals over a period of time, the data were not used as much to look at changes over time as to determine relationships between types of data using correlation and regression techniques.

The two previous studies were the only two identified which minimally conformed in part to the strict definition of a longitudinal study. The other studies identified in the literature as referred longitudinal studies used the more liberal definition discussed earlier.

One of these was a Career Thresholds study conducted by Herbert S. Parnes and associates at the Center for Human Resource Research at The Ohio State University (Parnes et al., 1971). The study was designed to gather data on four subsets of the population: men forty-five to fifty-nine years of age, women thirty to forty-four years of age, young men fourteen to twenty-four years of age, and young women fourteen to twenty-four years of age. The data were then analyzed for each group in an attempt to identify characteristics that appear to be important in explaining variations in labor market experience.

Another example of such a study is the Nurse Career Pattern Study (Knopf, 1975). The data were gathered from people who entered schools preparing registered

nurses in 1962, 1965, and 1967. The rationale for selecting longitudinal methods was similar to the underlying rationale used by many researchers. Knopf (1975) found that "it was expected that through following and surveying the same cohorts over a period of years a better picture of nursing students and graduates could be obtained than would be possible by other methods" (p.3). Collecting information on the same individuals over a period of time eliminated the need to assume that the people from whom the information was gathered were similar. They were not only similar, they were identical. Rarely can one go back to historical data stored in existing records to identify all of the information needed to classify individuals into groups for comparison. In a study designed to obtain information from the same individuals over a period of time, criterion data can be gathered to compare groups. Data can also be gathered which allow the members of the population being studied to be subdivided into samples for the study of questions of interest. For example, in the case of of the Nurse Career Pattern Study, biographical data were gathered on the students as they progressed through the program. Later, when it was determined which students graduated and which students withdrew, the two groups could be compared on the original biographical data. Using data such as these, it would be possible to divide groups according to some biographical characteristics and then to determine how many of each group withdrew or dropped out at a later date.

A similar rationale was incorporated into a six-year study of potential counseling aids for vocational students at the postsecondary level. Project MINISCORE was conducted in the state of Minnesota over a period of six years and funded by the U.S. Office of Education (Nelson and Pucel, 1972). A data base, including biographical information and test information upon application, was developed on approximately 15,000 students who applied for admission to the area vocational-technical schools of Minnesota. These individuals were then followed through their educational programs to determine which students were admitted or not admitted and which students successfully graduated or withdrew from programs. One year after graduation, those people who graduated and their employers were followed up on the job. It was then possible to study the relationships between the test data and other characteristics of students upon application and their success rates after completing programs. In addition, because the data base existed, numerous studies of interest to vocational educators in Minnesota were conducted.

Studies such as the Career Thresholds Study, the Nurse Career Pattern Study, and Project MINISCORE seem to be the most useful applications of the longitudinal method to vocational education. It does not appear practical to restrict use of longitudinal methods to those studies that gather the same information on the same group of individuals using the same instruments over a period of time. A broader perspective would be to gather information of interest from the same individuals over time whether or not it is necessarily the identical information and then to examine relationships among those data.

In addition to the studies reported above, there are a number of classic longitudinal studies which should be mentioned because they do provide information on techniques which may be applicable to studying vocational education. The major goal of these studies was to uncover relationships between the characteristics and histories of people and their career development.

One of the earliest studies was begun in 1921 by Lewis M. Terman (Terman and Oden, 1948). The study gathered data on 1,400 gifted children in 1921 and gathered follow-up data on these same children in 1927, 1936, 1940, and 1948. This study was aimed at being able to better understand what happened to gifted children.

In 1957, Donald E. Super and his associates described the framework for the research conducted during the Career Pattern Study (Super et al., 1957). This study gathered longitudinal information related to vocational development on a group of ninth grade boys from the time they were fourteen years of age until they were thirty-five. The basic purpose was to understand and develop a theory of vocational development.

Another well-known classic longitudinal study was Project TALENT (Flanagan and Cooley, 1966). This study was primarily concerned with various aspects of the career development of American youth. Information was gathered from a national sample of 400,000 ninth through twelfth grade students in 1960 with a battery of educational-psychological tests and inventories. Later relationships were sought between these data on the students and their subsequent vocational behavior after high school.

VOCATIONAL EDUCATION DATA AND LONGITUDINAL METHODS

In the final analysis, it appears that the basic purpose of vocational education is to provide educational programs that will assist students with the development of employment related skills and attitudes. Therefore, the primary concern of any vocational education evaluation system must be on the extent to which programs have the desired impact on students. Consequently, the students and programs become the central focus of data gathering. Data are then analyzed to examine relationships between student characteristics and the development and characteristics of the program. In this way it becomes possible to determine what types of program practices bring about the desired outcomes in student development.

Longitudinal methods become important in the study of the relationships between vocational program practices and student development. It is difficult to examine the relationships between students and programs unless the information is gathered on the same students and programs over time.

It is theoretically possible to set up experimental designs which require experimental and control groups and to randomly assign students to various educational practices which do not require longitudinal data. However, in practice this is rarely possible. It would not make sense for a vocational administrator to assign students to programs at random, and it costs money to identify and gather data from control groups that are not actually taking part in vocational programs.

It is also possible to identify groups of students and ask them what they did or thought earlier and to relate that to their present development. For example, people employed in unrelated occupations after graduation could be identified

and asked what their occupational goal upon entering the program was in order to determine if the occupations they entered are the ones they desired. At the same time, the results of such questioning are not always accurate. Looking back might not give the same results as would have been obtained if students were asked that question when they entered the program. Students might try to rationalize the occupations they actually entered by saying they are the ones they originally wished to enter even though they originally did not feel that way.

Another problem of having students look back is that certain data of interest might not be obtainable. For example, if one were interested in how many technical skills welders gained from a program, it would not be possible to determine how much skill they had when they entered a program if that data were not collected at the time of entry.

Gathering and storing longitudinal data in ways that allow them to be identified with a particular student allows for the use of methods that eliminate these and other problems. However, other problems do arise. For instance, if students are not assigned randomly to programs and educational practices, it is not possible to talk about causal relationships. Although this is a limitation, it still is possible to use correlational and other statistical techniques to examine relationships.

The storage of the data and the development of a continuing student or program record over time is another problem of longitudinal data. If the longitudinal data are to be useful, they must be stored in a composite record for each student and updated as more data become available on that student or the program in which he or she is enrolled. For only if the relationship is established between a particular student and the student's program can the statistical and analytical procedures which make longitudinal methods powerful tools be realized.

IMPLEMENTING LONGITUDINAL METHODS

As was pointed out earlier, the primary factor in implementing longitudinal methods is the availability of data gathered on the same individuals and their programs over a period of time. This allows for the investigation of relationships among information obtained on individuals and their programs as they progress through vocational programs. Currently, most vocational schools have the basic information necessary to create a longitudinal data base available to them. However, this information is stored in many different forms and locations. For example, student application information is stored with those people who counsel and admit students to the vocational school. Budgeting information is stored with the administrative offices. Student progress information is stored in files of transcripts. Placement and follow-up information is found in a variety of locations depending upon whether instructors keep the information or it is gathered in a central source. The same condition also tends to exist with data collected by state and federal agencies.

The major problem in the application of longitudinal methods to the investigation of vocational programs is that of gathering the information on individuals and their programs from many locations and converting it to a format allowing for the

investigation of relationships. Few people can obtain the data from this type of disjointed data system to apply longitudinal methods.

What are some possible solutions? The first step in developing a longitudinal data base is the development of a cross-referencing system that will allow information on a particular student to be referenced relative to that student, and information concerning a particular program to be referenced relative to that program. This would allow the application information on a student to be readily related to the follow-up information gathered later. Each program in a school would also contain identification information that would allow for situations as relating costs associated with a program to other information available on that same program. The link between the information on students and their programs would be simple. Part of the students' records would be the program in which they are enrolled and that could be indicated by the program identification information. Afterwards, one system would be developed to identify all of the information on a particular student and another to identify all information on a particular program. A file organization system would allow investigators to enter different files of information on programs, find information on the same program, enter different files of information on the same student, and find information on the student. These systems still would be mechanical systems of physically filing records and then gathering information from records. Although this would be a substantial improvement over the current situation where it is virtually impossible to cross-index various types of information on students or programs, it would still be cumbersome.

The next phase of making the system more sophisticated would be to develop a computerized storage system. The first stage of this process is the conversion of all of the information to a numerical coding system for a computer. Students and programs are usually assigned identification numbers. Each type of information to be stored is categorized and coded. For example, to identify the instructional styles of programs one would ask the question, "What are the various categories that might be used to describe the instructional style used in a program?" If five steps are identified, they would each be given a code number that can be stored in a computer. Although this sounds simple, it is a very complicated procedure because it is not easy to find systems that permit the description of some of the processes that are used in education. Many times these systems must be created. Some prototype coding systems have been developed for some of the variables of interest to vocational education as people have begun to develop management information systems in vocational education. Some example systems are included in Project Baseline (Lee, 1972), the Minnesota Vocational Follow-Up System (Pucel, 1973), Oklahoma's management information system, and the National Vocational Education Data System (VEDS) (VEDS Technical Assistance Workshop Manual, 1978).

After the numerical data codes are created for the program and student data, data on each program and student are stored in a computer or in some form of storage that can be computer input. Computers can easily store and access all of the information on a particular individual and can group that information together as long as the information available on a particular student or program has the same identification number on all records. Data stored in a computer becomes a readily accessible data base that can be used to examine relationships among various types of information.

To this point an ideal system has been described for implementing longitudinal methods. Many administrators feel that they do not need all of the information on all students in order to meet federal and state compliance reports or to provide adequate descriptions of what is occurring within their schools, districts, or states. They argue that a sampling approach can be used to gather the information which greatly reduces the amount of effort and resources needed to gather, analyze, and store the information. This is a legitimate argument, but if the information system is well-planned, it should be possible to sample a group of people upon admission to programs and then to utilize that same sample as they progress through the vocational programs, including the postgraduation follow-up. Using this approach, the information would still be gathered on samples, but all of the information would be gathered on the same samples, which would allow for studying interrelationships among the various types of information. The current approach used by most schools, districts, and states is to draw a separate sample for each type of information needed. It is easier to draw a sample from the group of people that are available at a particular point in time and then to report information on that group, than it is to try to keep track of information on a particular group of individuals over a long period of time. The latter approach requires keeping better records on individuals and determining what happens to each member of the original sample. However, if all of the various types of information required are gathered on the same sample, longitudinal methods can be applied to those data.

Some of the general types of statistical procedures that are used with longitudinal data should be mentioned. Data contained in a longitudinal data base generally are analyzed using some form of regression or correlational analysis. That is one reason for storing information in numerical code. Other techniques can be used to examine differences between groups on the same types of information, but certain assumptions have to be made about the equivalence of the groups that are to be compared. Rarely can vocational educators use random sampling procedures that underlie the assumptions for most between-group tests. However, with the types of information that can be included in a longitudinal data base, one can attempt to obtain essentially equal groups by matching many characteristics of the groups to be studied. Many researchers feel that matched groups provide a reasonable basis for using techniques such as analysis of variance, chi-square analysis, and other between-group comparison techniques even though some of the sampling assumptions are not met.

BASIC DATA REQUIREMENTS

What types of data should be gathered for longitudinal methods in evaluating vocational education? The primary types of data should pertain to students and programs. In the review of the literature, an effort was made to identify those data elements that seemed to appear consistently among various follow-up and evaluation systems in vocational education. In order to identify a structure for the types of data, the literature was reviewed in terms of the classifications of data provided in The Minnesota Vocational Follow-Up System: Rationale and Methods (Pucel, 1973). This document listed major categories of data that might be useful to vocational educators in planning and evaluation.

If data were identified in the literature that were not contained in those classifications, the classification system was expanded. The basic categories of data elements are presented in Table II, "Basic Longitudinal Student and Program Data." They are divided into three major types of information: (1) input, (2) program process, and (3) output.

Most of the data shown are obtained from students as they progress through a vocational program. The only program characteristic information included is the description of the nature of the instructional program actually being delivered to students. There are additional program characteristic data that could be gathered concerning the planning and operation of the total school which could be related to an instructional program. Examples include the type of admission procedures that are used to enroll students and the amount of resources available for student admissions, or the hiring policies for staffing instructional programs. Such information has not been included since it does not relate directly to the instructional interaction between the students and the program which is preparing students to enter the world of work. Also, types of information that allow one to define the context within which vocational programs are conducted, such as labor market demand and economic condition of the country, are not included. However, it should be recognized that any total information system should include these types of information.

Input Data

As shown in Tables I and II, input information includes both biographical and enrollment information. The primary purpose of this information is to describe the student population and to provide data concerning the enrollment of students in vocational programs.

These two types of information are usually gathered at one of two different points in time. If one is interested in the nature of all applicants, the biographical information is gathered at the time of application, and enrollment information is gathered when those accepted enroll. If information is only desired on those who enroll, both types of information are gathered at enrollment. There are a number of advantages to gathering information on all applicants in a longitudinal system. For example, it makes it possible to compare those who are accepted with those who are not, or to identify applicants who were not accepted in order to compare later job success of those who took part in vocational education with those who did not.

Biographical Information

Biographical data can be divided into four subcategories: (1) identification information, (2) categorical information, (3) history information, and (4) test information. Identification information allows for the identification of a particular individual and also provides information which might be useful in identifying or locating that person in the future. As can be seen from Table I, this type of information generally includes items such as Social Security number, name, permanent address, telephone number, parent or guardian name, parent or guardian address, and parent or guardian telephone number.

Categorical information provides a basis for categorizing students for future reporting to state, federal, and local governments or for sampling for other studies. For example, if a question arose concerning the differences between the percentages of males and females who graduated versus those who withdrew from a particular program, it would be necessary to know which students were male and which were female. In that situation, the essential piece of categorical information would be the sex of the student. Some types of categorical information are age, sex, marital status, annual income of household, number of people living in household, ethnic background, and types of handicaps.

History information provides information on the background of the students. Generally, in vocational education these data elements relate to prior educational and work history. This information can be used to determine what an individual has done in the past that might be related to future performance. When included in a longitudinal data base, it allows one to study questions like, "Does prior work experience in a vocational area have an effect on a person's success in vocational education in that area?"

Another major category of biographical information pertains to an individual's instructional readiness to enter vocational programs. This information is often referred to as "test-data" since it is usually gathered with formal assessment instruments. However, the intent is to determine instructional readiness. The major purpose for gathering this information is to assess an individual's potential for success in educational programming. It usually attempts to identify interests, prior skill development in the area of training, and basic scholastic achievement in areas such as reading, writing, and arithmetic. When included in a longitudinal data base, these data allow one to study questions like "What types of special needs support are needed by students who enter programs with particular levels of instructional readiness?" and "What is the likelihood of success in a particular vocational program of people who have various levels of basic learning skills?"

Enrollment Information

Enrollment information is used to describe the program in which a student enrolls. It includes information such as whether an individual who applied for admission to a particular program was accepted, the program in which the person enrolled, and the program starting date. To a large extent the enrollment information can also be considered categorical information because it is used to identify enrollment categories of entering students and applicants. When included in a longitudinal data base these data allow one to study questions like "Are there differences in the vocational program successes of people who enter programs at different times of the year?" or "Do graduates of different programs experience different rates of success?"

The enrollment information in addition to the biographical information allow for a description of the student upon entering the vocational program. They permit the future identification of samples of interest so that certain relationships can be studied and are useful in the preparation of federal, state, and local reports.

TABLE I – EXAMPLES OF INPUT DATA

Biographical	Enrollment
Identification Information • Social Security Number • Name • Permanent address • Telephone number • Parent or guardian name • Parent or guardian address • Parent or guardian telephone number Categorical information • Age • Sex • Marital status • Annual household income • Number of people living in household • Ethnic background • Types of handicaps History Information • Major activity during previous year • Last high school attended • High school graduation and year • Number of years of education • Prior vocational education • Prior work experience Instructional Readiness Information • Level of prior skill development in area of training • Interests • Basic learning skills • Aptitudes • Scholastic achievement	Program acceptance Program in which enrolled Program starting date

TABLE II – BASIC LONGITUDINAL STUDENT AND PROGRAM DATA

INPUT		PROGRAM PROCESS		OUTPUT		
Biographical	Enrollment	Student Progress	Program Characteristics	Termination	Initial Placem't	Follow-Up
• Identification • History • Categorical • Instructional readiness • Etc.	• Program acceptance • Program in which enrolled • Program starting date • Etc.	• Grades • Competency attainment • Progress in special needs activities (if any) • Attendance • Behavior problems • Etc.	• Professional resources • Capital expenditures • Supplies allocated • Curriculum style • Instructional activities and materials • Special needs resources • Administrative style • Program content • Etc.	• Graduation • Withdrawal • Completed training objective • Etc.	• Placement rate • Relatedness of placement • Time between graduation and placement • Etc.	• Employment history since leaving program • Current employment status • Judgements of training program based on job experience • Employer evaluation of performance • Etc.

Program Process Data

As indicated in Table II, there are two basic types of program process data that should be included in a longitudinal data base: (1) student progress data, and (2) program characteristic data.

Recent legislation has placed pressure on educators, including vocational educators, to pay more attention to the relationship of program process data to individual students. The primary example is the requirement for IEPs (Individualized Educational Plans) contained in P.L. 94-142 (Education for All Handicapped Children Act). Most educators are currently aware of the requirements of this planning process which include an educational prescription, the accountability requirements, and the legal processes that may be involved for noncompliance. This legislation places more emphasis upon keeping longitudinal records of program process as it relates to individual student performance.

Student Progress Information

Student progress information is used to record a student's progress through a program. The primary use of student progress data is to monitor the completion of program requirements by the student. Traditionally, schools have broken down programs into courses and, recently, some have broken them down into competencies. Regardless of how the program components are defined, progress is usually recorded for each of these components in the form of grades. Grades are not the only type of student progress data. Other possible data are attendance, behavior problems, and progress in special needs activities.

Traditionally, schools have gathered and stored student progress data in a longitudinal fashion because they were required to communicate the progress of students to others, such as other schools to which students wanted to transfer, parents, and employers. When student progress data are included in a longitudinal data base, they allow one to study questions like "Does successful performance in a vocational program relate positively to success on the job?" or "Do students with certain biographical characteristics experience more attendance problems?"

Program Characteristics Information

Currently, information on program characteristics is probably the most fragmentary data for educators. Some data, such as information on curriculum styles used in programs and types of materials and activities contained in programs, are not recorded, although they are available in teachers' files. Other management information such as costs and other resource allocations is required for budgeting and managing programs, but it is stored separately and is not available and, therefore, cannot be related to other data.

Program characteristic data are used to describe the educational activities students engage in while developing employment related skills and attitudes.

A more detailed description of these characteristics will enable a more detailed investigation of what factors lead to successful programs. Examples of these data include information on professional resources, capital expenditures, curriculum style, program content, instructional activities and materials, special needs resources and administrative style.

When program characteristic information is included in a longitudinal data base it is possible to study questions like "What type of curriculum style is most effective in teaching a particular type of student in a particular vocational program?" or "What differences are there in the costs of assisting a special needs student through a vocational program as compared with other students?"

Output Data

The third major category of data that should be included in a longitudinal data base is output data. As indicated in Table II, output data can be classified into three types: (1) termination data, (2) initial placement data, and (3) follow-up data. These data are used to describe how students leave a program and what happens to them after they leave. Output data have been gathered by vocational educators for many years to satisfy local, state, and federal requirements. However, few schools have gathered it in a longitudinal manner so all three types of data have not been gathered on the same individuals and therefore they cannot be related to one another.

Termination Information

Termination information describes how an individual exits from a vocational program. Those who enroll in vocational programs usually exit in one of three ways: (1) graduation, (2) withdrawal, or (3) completion of a training objective without graduating. Most vocational educators consider an individual as having completed a training objective when that person completes a previously determined set of goals without completing all of the requirements necessary for graduation. One problem facing vocational educators when collecting termination information is setting up a clear set of rules for defining when an individual actually completes a training objective or withdraws.

When termination information is included in a longitudinal data base it allows one to study questions like "What types of students tend to successfully graduate from a vocational program?" or "What types of curriculum styles lead to certain types of special needs students successfully graduating from vocational programs?"

Initial Placement Information

Initial placement information includes a description of whether graduates of vocational programs were employed after graduation and whether they were employed in related occupations. Recently some people have also begun to include information on the length of time it takes a person to gain employment, particularly related employment. Initial placement data have been gathered for many years

as part of local, state, and federal compliance requirements for the funding of vocational programs. It has been the major type of information used to judge whether students were meeting a primary goal of vocational education, obtaining jobs in training related occupations. However, these data have been gathered basically as descriptive "one-shot" information and have not been gathered or stored with the idea of analyzing the process of vocational education leading to successful placement. Most vocational schools cannot currently relate the placement or nonplacement of students to other data which they previously gathered about a student and the program. If placement information could be related to other data, vocational educators could study questions like "What educational program characteristics and student characteristics of graduates lead to high placement rates?"

Also, such information has been largely restricted to information gathered from graduates of vocational programs. This does not allow for a comparison of the effects of vocational education on the empoyment potential of individuals. In order to study that problem, data must be gathered from applicants who were not enrolled in vocational programs as well as people who enrolled but did not graduate from the programs. The current inability to answer important questions concerning vocational education from initial placement data suggests the importance of its inclusion in a longitudinal data base so interrelationships can be studied.

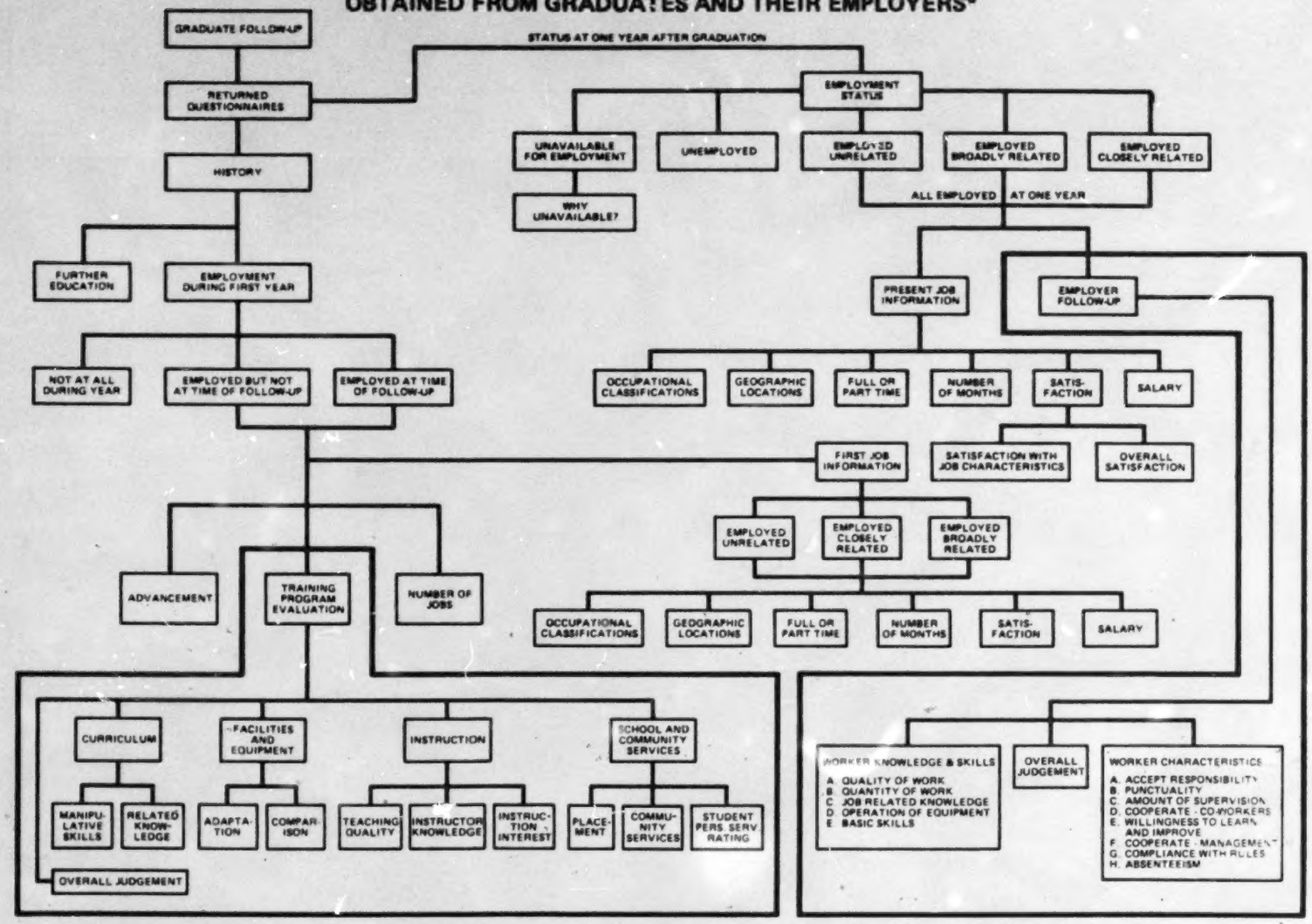
Follow-Up Information

Follow-up information is usually considered by vocational educators to be information gathered on graduates of a program at some point after they have left the program. Some educators consider initial placement information to be follow-up information, but for purposes of this paper it is treated separately. Follow-up, as defined here, relates to gathering information from individuals after they have had time to develop a postgraduation work history of six months.

Many types of follow-up data can be gathered and classified in numerous ways. In this paper the follow-up data have been classified into four major types: (1) employment history, (2) current employment status, (3) graduate judgments of training program based on job experience, and (4) employer evaluation of performance. These categories represent minor modifications of the classification system presented in The Minnesota Vocational Follow-Up System: Rationale and Method (Pucel, 1973, p. 53). That system is presented in "Possible Organization of the Follow-Up Information Obtained from Graduates and Their Employers" (see Table III) which indicates the types of information that might be included in each of the four major categories. To be most useful, these data should be included in a longitudinal data base. If the follow-up data are included in a longitudinal data base they allow one to study questions like "What types of program characteristics tend to lead to improved employer evaluations of the performance of program graduates?"

TABLE III

POSSIBLE ORGANIZATION OF THE FOLLOW-UP INFORMATION OBTAINED FROM GRADUATES AND THEIR EMPLOYERS*



*Reproduced from Pucel, David J. *The Minnesota Vocational Follow-Up System: Rationale and Methods.* Department of Vocational and Technical Education, University of Minnesota, Minneapolis, MN. 1973, p. 53.

SUMMARY

Based on a review of the literature, it is apparent that few vocational educators have attempted to apply longitudinal methods in the past. However, longitudinal methods do appear to be very useful techniques in the study of many of the questions currently being asked by the critics and the funders of vocational programs. If longitudinal methods are used appropriately, questions such as the following may be asked:

1. Does vocational education make a difference?
2. What program practices increase the possible success of vocational graduates?
3. What are the additional costs of preparing special needs students?

These questions, as well as many others can be addressed in a straightforward manner. In addition, they can be used to develop longitudinal data bases which would provide the information for many of the state, federal, and local reports on vocational education.

There are drawbacks to the use of these methods, however. The development of a longitudinal data base which could support the use of longitudinal methods requires the gathering of information on the same individuals or programs over a period of time and the storage of that information. This complicates the data gathering processes which are being used by vocational educators today. Most vocational educators currently conduct descriptive studies aimed at collecting information needed to meet reporting requirements. Little attempt is made to relate one type of information to another. However, even though the data gathering processes associated with longitudinal methods are more complicated than currently utilized procedures, a well-developed longitudinal system would facilitate the generation of data for vocational education decision making and reporting.

If longitudinal data bases were generated on a continual basis, the basic problem of length of time associated with the use of longitudinal methodologies would be eliminated. If the relevant data were gathered on a continual basis, it would be possible to ask questions and to investigate relationships using data continually available in a longitudinal data base rather than having to wait for an extended period of time to gather all of the necessary information. This would make it more feasible to address questions about relationships between changes in vocational programs and effects on students.

In order for vocational education schools, school districts, or state departments to utilize longitudinal methods to full advantage, they will need prototype systems which they can implement or modify. Although some of the techniques discussed in this paper can be implemented by educators familiar with the development of education data systems, most education agencies do not have personnel that could develop those systems. However, with prototypes many could be implemented with the assistance of local and statewide computing systems. It is recommended that resources be made available to develop prototype systems which can be quickly implemented by vocational education institutions.

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